Space Optical Communications in the Global Information Infrastructure

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Abstract

The application of laser intersatellite and space-to-ground links in the emerging Global Information Infrastructure will be discussed, along with NASA's programs to create, evaluate and validate the laser communications technology. These programs include the development of a minimal complexity lasercom terminal, assessment of the atmospheric effects on optical communications links, and plans for an industry-led space demonstration of laser communications technology.

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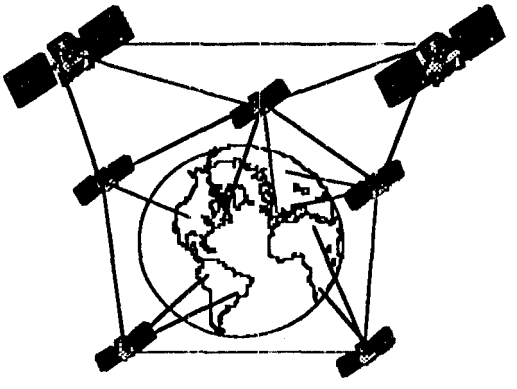
SUMMARY

The information explosion is producing ever increasing demands on systems that move data from one point to another. Computer connectivities to the work place, or to the home, will enable vast quantities of data (text, imagery and movies) to be assimilated and processed. As users demands increase, so to will the need for high data rate trunking of aggregate data sets. Much of this data flow will be handled by fiber optic networks, However, for areas where deployment of fibers is either delayed, or is cost-prohibitive, the use of satellite links will become extremely attractive, especially if data rates in the 1-5 Gbps can be handled. Fortunately, such data rates can be easily handled with space optical communications technology,



This paper will describe recent advances in space optical communications technology and systems designs that will enable links in the Gbps region. Developments of a very simple but highly capable laser communications terminal called the Optical Communications Demonstrator will be described. This terminal uses a simplified architecture employing only a single 2-axis steering mirror and a single photodetector array to accomplish beacon signal acquisition, tracking and transmit beam pointing. Also discussed is a program to experimentally collect data on the throughput characteristics of the atmosphere. A set of three autonomous observatories,

programmed to measure the preselected stellar intensities, has been built and deployed throughout the southwestern US. Data collected from these observatories is being used to produce detailed statistical visibility models of the atmosphere, and will be used to predict the performance of a spatially-diversified ground-based network for receiving optical signals from space.

Finally, an industry-led program to study and propose a space demonstration of optical communications technology at a data rate of 750 Mbps will be described. This program commenced with an assessment of the commercial applications for laser communications links. These applications included many of the proposed multiple-satellite networks intended for both fixed and mobile communications services. Next, the objectives and requirements for a space-flight demonstration of the technology were formulated. These requirements were then flowed down through candidate dernonstration concepts to produce specific experiment requirements and a resulting point design. The point design included riot only the definition of an optical communications demonstration terminal(s), but evaluation of candidate host space platforms, launch vehicles, orbits and operational concepts. The studies ended with the formulation of the demonstration program plans. Two parallel industry study contracts were awarded in July 1994 to teams headed by Motorola and Ball Aerospace, and are due to be completed in April 1995.

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